CORNING GLASS WORKS
ELECTRO-OPTICS DEPARTMENT
RALEIGH, NORTH CAROLINA

IMPROVED SCREEN FOR REAR-PROJECTION VIEWERS

Technical Report No. - 38
Date - February 28, 1969
Period Covered - January 31, 1969
to
February 28, 1969

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1. Scattering Screens

A number of both small and full size screens have been cast in the program to produce usable 12-1/8" x 15-1/8" samples for subjective evaluation.

1.1 Scattering Layer Variations

The parameters which have been varied are glass particle size, glass-binder ratio, glass-binder index difference, and layer thickness. Since there is no clear-cut analytical relationship between these parameters and the resulting screen characteristics, it was decided to vary each parameter initially in order to determine which would prove to be the most controlling or the most convenient. The results of measurements on some of these screens are displayed in Table I, where T_θ is the percentage of an incident parallel beam scattered into a cone of half-angle θ, $V_\theta = [B(0) - B(\theta)]/[B(0) + B(\theta)]$, and $B(\theta)$ is the brightness.

1.2 Surface-Scattering Versus Volume-Scattering

Screens AA-1, AB-3, and AC-2, having a glass-binder refractive index ratio of 1.04, exhibit predominately surface-scattering at the interface between air and the scattering layer. This is demonstrated by Fig. 1 which shows very little scattering by screen AB-3 when a matching index oil is spread over the scattering layer. The advantage of surface scattering is that a very thin effective scattering region can be retained even though the total layer thickness is increased for utility in application of the layer. On the other hand, it may be more difficult to control the surface scattering properties since the surface contour has a complicated dependence on particle size distribution and shrinkage of binder when the coating dries. Some evidence of this problem is that scintillation occurs for the screens with low index ratio but not for those of high index ratio, where volume scattering occurs.

By subjective tests, scintillation appears definitely to reduce the effective resolution of a screen. Consequently, if time permits, both high and low index ratios will be evaluated.

1.3 Trapped Projector Light

Since these screens are expected to be used under well controlled ambient light conditions, trapped projector light becomes the dominant factor in the resolution and contrast performance, especially in regions of low brightness. Analysis of this problem and means of measuring the trapped light are being pursued along with the above-described empirical testing of various screens. Further details will appear in a subsequent report.

2. Lenticular Screens

Inquiry has been made at two firms into the possibility of producing cylindrical lenticular plastic sheets 1 - 3 mils thick and having a 1 - 3 mil lenticule spacing. We have a quotation from the one source and are awaiting a quotation from the other. The methods of fabrication are somewhat different, but both require a metal master. In both methods, one of the major pieces of information to be gleaned from the experiment would be the precision with which such small lenticular surfaces can be formed by machining.

TABLE I

SAMPLE SCREEN PARAMETERS AND MEASURED CHARACTERISTICS

Sample	Glass Index / Binder Index	Glass Volume / Binder Volume	Layer Thickness (Microns)	Particle Size	Axial Gain	T_{90} (%)	T_{45} (%)	V_{45} (%)	T_{30} (%)	V_{30} (%)	Scintillation
AA-1	1.04	0.57	17	coarse	15.5	76	71	94	61	80	strong colored
AB-3	1.04	1.00	19	coarse	7.89	65	50	83	38	69	moderate colored
AC-2	1.04	2.00	22	fine	1.79	49	27	29	15	27	moderate white
AD-2	1.2	2.00	17	fine	0.54	27	13.4	2	6.6	1	none
AD-3	1.2	2.00	8	fine	0.97	40	20.5	8	10.3	9	none
AD-4	1.2	2.00	30	fine	0.40	20	10.1	2	5	1	none
AE-1	1.09	2.00	10	fine	1.25	49	25.5	11	13.1	11	weak white

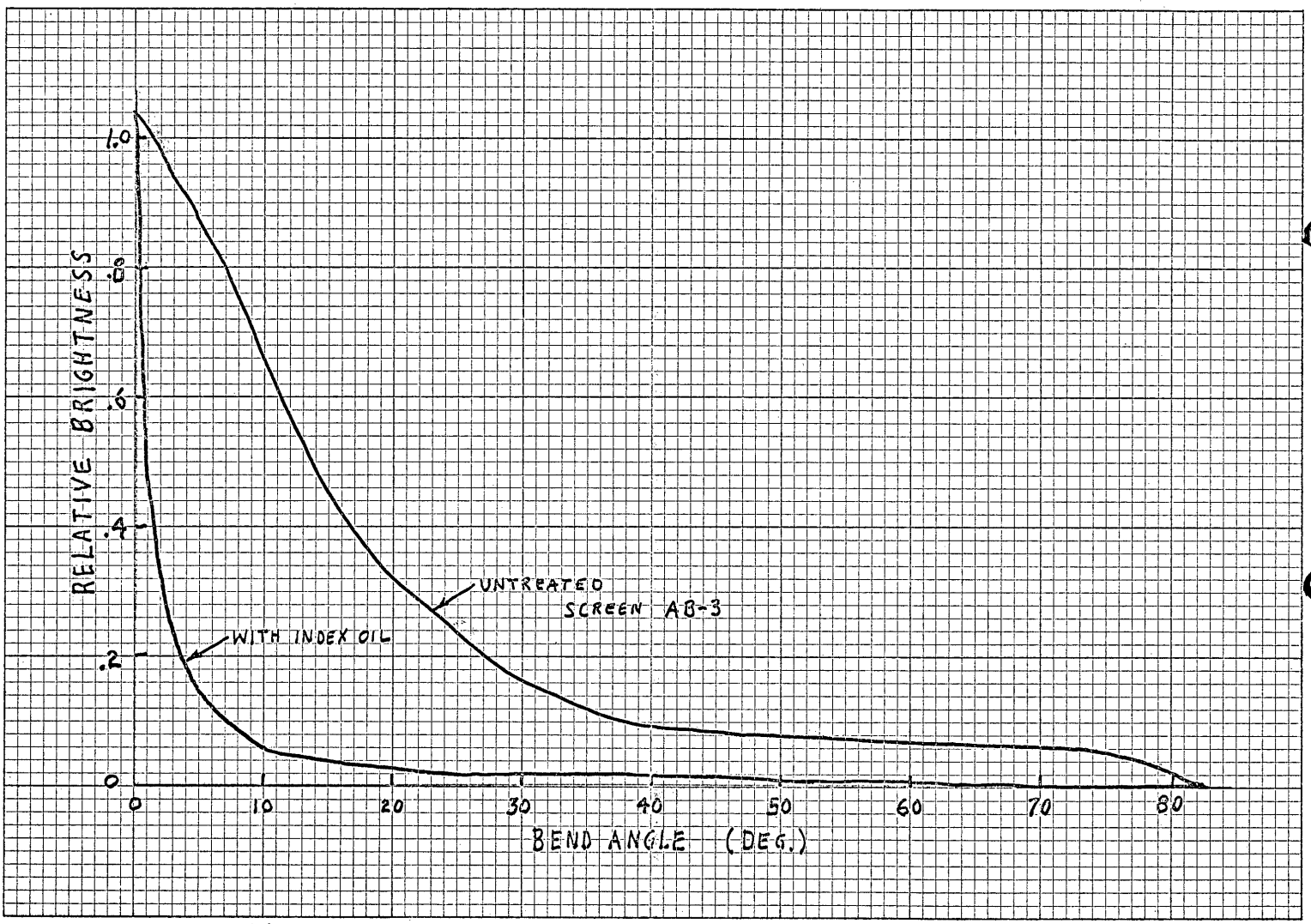

Figure 1. Relative brightness distribution for screen AB-3 with and without

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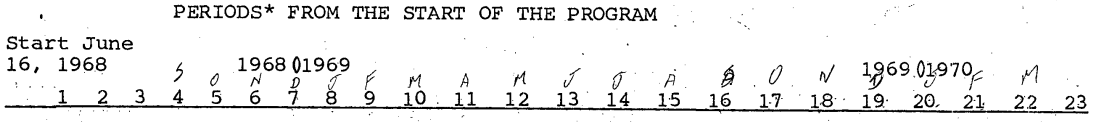
PERIODS* FROM THE START OF THE PROGRAM



System Analysis

a) Screen Improvement

b) Reduction of Surface Reflections

c) Substrate Darkening Investigations

d) Sample Screen Fabrication

e) Application Evaluation

Lenticular Screens

a) General Investigations

b) Optical Quality Improvement

c) Mechanical Integrity Improvement

d) Develop Self-aligning Mask

e) Sample Screen Fabrication

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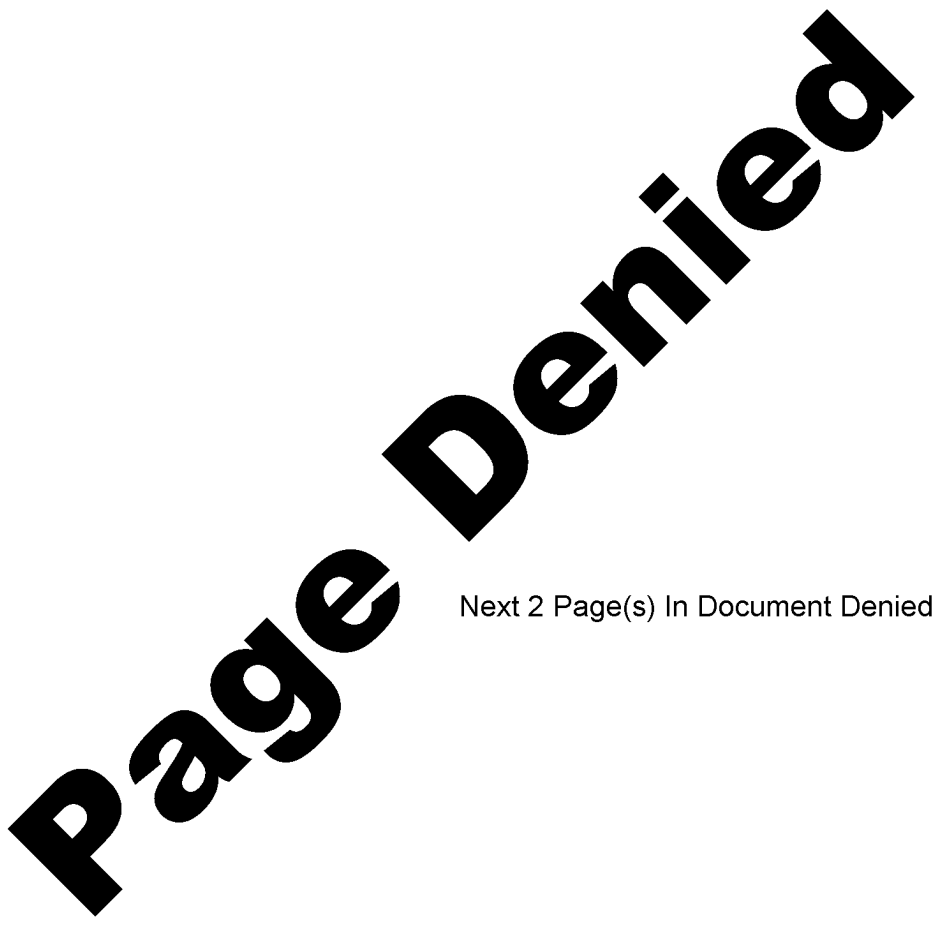
*1 Period equals 4 weeks.



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